AMENDMENT AND RESPONSE UNDER 37 CFR § 1.116 – EXPEDITED PROCEDURE   Page 14
Serial Number: 10/087,296   Dkt: 1488.008US1
Filing Date: March 1, 2002
Title: A TECHNIQUE FOR COMPILING COMPUTER CODE TO REDUCE ENERGY CONSUMPTION WHILE EXECUTING THE CODE

REMARKS

This responds to the Office Action mailed on <u>October 20, 2005</u>.

No claims have been amended. Claims 1-44 are now pending in this application.

§103 Rejection of the Claims

Claims 1, 2, 11-15, 22-25, 32-36, 43 and 44 were rejected under 35 USC § 103(a) as being unpatentable over Bartley (U.S. Patent No. 6,219,796) in view of Y. Li et al. This rejection is respectfully traversed.

Y. Li et al. is used to modify cache and main memory size to trade off performance and energy use goals. It has nothing to do with inserting power down instructions. Barley describes inserting instructions to turn a processor off and on, and has thresholds to make sure that at least some benefit is provided by doing so. Neither reference, alone or combined discusses inserting power down instructions to reduce power consumption while satisfying user-specified real-time constraints. The references are also not properly combinable, as no proper motivation to combine them has been provided, and is it not clear how they can be combined to arrive at the claimed invention.

The Office Action that Bartley discloses that segments would be of longer duration than some predetermined threshold, and indicates that the threshold **inherently** must be predetermined or user specified. This statement is respectfully traversed, as it is based on inherency. The Office Action has not established a *prima facie* case of inherency because, as recited in MPEP § 2112, "In relying upon the theory of inherency, the examiner must provide basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic <u>necessarily</u> flows from the teachings of the applied prior art," citing <u>Ex parte Levy</u>, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original).

The Office Action only argued that a "the threshold inherently must be predetmermined or user specified." It should be noted that this statement in itself provides an alternative way of determining the threshold other than user specified. As such, it shows that the result does not necessarily flow from the cited langauge, and the rejection is improper.

Further, as the time threshold is related to determining whether there would be any benefit obtained by powering down, it is clearly not a user specified real-time constraint. The Office Action does not even assert that the allegedly inherent characteristic is necessary, let alone provide a basis in fact and/or technical reasoning. Applicant respectfully submits that the threshold of Bartley is determined in the following manner, which is clear not user specified: "Various power modeling techniques can be used to determine the length of time during which it is more efficient to turn a component off (or partially off) then on again versus leaving it on." Col. 7, lines 16-19. Each threshold appears to be fixed and based on efficiency, not user specified time constraints. Thus, the claim language of inserting power-down instructions while satisfying user-specified real-time constraints does not necessarily flow from the cited language of Bartley, and the rejection should be withdrawn, as at least one element of the claims is lacking from the combination even if proper.

In practice, with the presently claimed invention, there may be many places in code where a power down instruction could be added. The claimed invention allows one to determine where to put them to optimize power consumption within user specified constraints, to make sure that the overall program performance is as desired. Neither reference, alone or combined provides this capability.

Regarding page 4 of the Final Office Action, section C, the Examiner indicates that powering down different functional units is not in the claims. This is true. Applicant has not argued that they are. Any statements describing different functional units related to Bartley, not the pending claims.

The response to the prior rejection is included below for completeness.

The Final Office Action states that Bartley does not disclose "…satisfying user-specified real-time constraints.." , but then indicates that Li et al., discloses "…satisfying user-specified real-time constraints…". The Final Office Action then indicates that it would be obvious to combine Bartley and Li et al. Applicant does not believe that the references are properly combinable, as each is directed to very different aspects of power reduction.

Bartley inserts power-down instructions into programming with the goal of reducing power consumption. Li et al., describes a very different type of system. In Li et al., an

embedded system is described, where the software and hardware components are designed and modified with power conservation in mind. Software may be transformed, and different sizes of cache and main memory are considered to optimize power conservation. In that process, which is very different from the power down aspects of the present application and Bartley, there is no consideration of powering down different components. Rather, the components themselves may be modified in size to conserve power.

As can be seen, the approaches of Li et al. versus those of the present application and Bartley are very different. While both may be directed to improving energy consumption, there is nothing in Bartley and Li et al. that indicate different aspects of them may be combined. The Office Action first indicates that the motivation to combine them comes from Bartley, "as he refers to program segments having a duration longer than a "predetermined threshold." (Column 7, lines 42-43) , wherein it is obvious the threshold may be determined by a user either via a user selected algorithm or other user input." This appears to be stating that the claim language "satisfying user-specified real-time constraints" is inherent in the teaching of Bartley. As indicated above, it is not believed inherent.

The purported motivation to combine the references is in the context of finding code segments of long enough duration to make it worth shutting down a functional unit. If it would take longer than the amount of time required for execution of the segment to turn it off and then turn it back on, it would not make sense to turn it off in the first place. "Various power modeling techniques can be used to determine the length of time during which it is more efficient to turn a component off (or partially off) then on again versus leaving it on." Col. 7, lines 16-19. It does not relate directly to satisfying user-specified real time constraints or program performance as currently claimed. As such, it would not suggest to one of skill in the art that performance optimization goals should be considered. In practice, with the presently claimed invention, there may be many places in code where a power down instruction could be added. The claimed invention allows one to determine where to put them to optimize power consumption within user specified real-time constraints.

Li et al. does not provide power down instructions, but instead changes sizes of caches and main memory to obtain user specified performance and energy use goals. The Office Action

indicated that Li et al. disclosed "…satisfying user-specified real-time constraints…" It should be noted that Li et al., describes different optimization goals in the context of changing sizes of cache and main memory, not in the context of powering down different functional units. Thus, it is not proper to ascribe the performance constraints in this context with the insertion of power conservation instructions. One relates to hardware design, and the other relates to programming existing hardware. This great difference in architecture and methodology of conserving power makes it highly unlikely that Li et al., would be considered by one of skill in the art when focusing on powering down different functional units. It also places the likelihood of success of such a combination in great jeopardy.

Claims 3-10, 16-21, 26-31 and 37-42 were rejected under 35 USC § 103(a) as being unpatentable over Bartley (U.S. Patent No. 6,219,796) in view of Y. Li et al. ("A Framework for Estimating and Minimizing Energy Dissipation of Embedded HW/SW Systems", Proceedings of the 35th Design Automation Conference, (1998), p. 188-193), and further in view of G. Ramalingam ("Data Flow Frequency Analysis", SIGPLAN Conference on Programming Language Design and Implementation, 1996). This rejection is respectfully traversed, as all depend from independent claims that are believed allowable.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (612) 373-6972 to facilitate prosecution of this application.

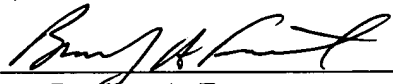If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

ANIL SETH ET AL.

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 373-6972

Date _12-20-2005_   By _____
                                              Bradley A. Forrest
                                              Reg. No. 30,837

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop AF, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 20th day of December, 2005.

_____Jonathan Ferguson_____   _____

Name   Signature